



AMENDMENTS

IN THE SPECIFICATION:

Please amend the specification as follows.

1. Please amend the paragraph at page 1, lines 7-9 by replacing it with the following rewritten paragraph:
-- The present application claims the benefit under 35 U.S.C. 119(e) of the priority date of Provisional Application Serial no. 60/445,329 filed ~~46~~ February 5, 2003, which is hereby incorporated by reference. --
2. Please amend the paragraph at page 2, lines 8-21 by replacing it with the following rewritten paragraph:
-- An object of the present Invention is to help return a crew operating a vehicle, like a space shuttle, when compromise of the vehicle's thermal-protection surface could lead to catastrophic loss of crew and vehicle. Of the 113 shuttle launches during a 22 year period, the safe return of crews was achieved ~~achieved~~ 98.3% of the time. In the only two exceptions, crews may have safely returned using existing operational capabilities of the shuttle. One of the two vehicles was Challenger, ~~43~~ Jan. 28, 1986, whose crew consisted of commander Francis R. Scobee, pilot Michael J. Smith, and astronauts Judith A. Resnik, Ronald E. McNair, Ellison S. Onizuka, Greg B. Jarvis (a fellow member of the technical staff at what was then Hughes Space and Communications Group), and Sharon "Christa" McCaliffe. The other vehicle was Columbia, Feb. 1, 2003, with commander Rick D. Husband, pilot William C. McCool, and astronauts Michael P. Anderson, Kalpana Chawla ("Culp-na Chav-la"), Laurel B. Salton Clark, David M. Brown and Ilan Ramon. This Invention is motivated out of respect for the profound commitment these

husbands, wives, fathers, mothers, sons and daughters made in a shared national and international purpose. And it respects the sentiment of the only U.S. president ever to be --

3. Please amend the paragraph at page 3, line 7 by replacing it with the following rewritten paragraph:

-- President Abraham Lincoln, Gettysburg, ~~d5~~November 19, 1863 --

4. Please amend the paragraph at page 3, lines 9-14 by replacing it with the following rewritten paragraph:

-- Providence's wisdom, in permitting the U.S. Constitution to exist in its present form, allows a citizen to present a petition, such as this one, regarding useful innovation that may benefit society as a whole. Though powerless while receiving the news reports of Columbia a year ago, ~~d7~~Feb. 1, 2003, developing this Invention was the only means available for this writer to check the downward cycle of despair that enveloped himself, his fellow Caltech alums, the nation and the world, as occurred 17 years prior, with Challenger on ~~d3~~Jan. 28, 1986. --

5. Please amend the paragraph at page 4, lines 26-27 by replacing it with the following rewritten paragraph:

-- NACA constituted sacrifice, on an unprecedented scale, to advance the aeronautic arts. And NASA benefited ~~benefitted~~ from that knowledge, advancing it far beyond what the NACA charter could --

6. Please amend the paragraph at page 7, lines 12-19 by replacing it with the following rewritten paragraph:

-- Thus, this Invention is a declaration of honor and gratitude to NASA, its current administrator, its past administrators, and its talented explorers, scientists, engineers, technicians, management, administrative, operations and support staffs who have carried

the torch through the unknown, and lighted the way for an unlimited future that awaits a new generation, with courage and dedication to embrace and advance what NACA and NASA have set before mankind. This will not be achieved within the first 100 days of NISAA, nor perhaps the first thousand days, nor within the present generation. There may yet be unforeseen ~~unforseen~~ set backs. But with the steady confidence and progress NACA and NASA established, let us begin. --

7. Please add a NEW paragraph after the paragraph that begins with "Figure 2." at page 9, lines 19-22. The NEW paragraph reads as follows:
 - Figure 3. shows a rocket having continuity loops attached above and below the seams of the sections of the rocket. --
8. Please amend the paragraph at page 10, lines 2-12 by replacing it with the following rewritten paragraph:
 - The present invention provides a 100 sensor grid on the surface area of a vehicle (Figure 1). The preferred embodiment is described of a system and attached apparatus for detecting thermal integrity of a protective layer on a vehicle's surface, such as a shuttle, during its operation. Figure 2. shows the vertical grid elements 200 that attach to the surface areas of interest through either mechanical or adhesive technology, or are suspended above the areas of interest with suspension points at intervals across the surface areas of interest. The Invention detects compromise of all or part of the grid elements. The option of multiple contact points and feeds along any grid element is not excluded, which permits other grid elements to continue operating around a compromised area, allowing horizontal multiplexor 220 and vertical multiplexor 205 to receive redundant data, or to receive localized data independent of other grid areas. Connective terminals or fasteners or sockets allow grid elements to attach to vertical multiplexor 205. The same is true also for horizontal grid elements 225 and horizontal multiplexor 220.

9. Please amend the paragraph at page 13, lines 13-20 by replacing it with the following rewritten paragraph:

-- An additional embodiment is to include 310 "continuity loops" above and below the 305 seams of the sections of solid rocket boosters attached to a shuttle (Figure 3). Such wire, fiber optic, conducting paint, or other lines of material would be on the circumference of the booster cylinders (or other areas of the vehicle) above and below sections that are sealed together. Each 310 loop could be within protective insulation or covering. The 310 continuity loops may be redundant and also use a twisted pair topology to reduce noise. The material and insulation used to make the 310 "continuity loops" would melt through when a localized temperature on any part of a loop is elevated beyond a pre-determined threshold. --

10. Please amend the paragraph at page 14, lines 1-10 by replacing it with the following rewritten paragraph:

-- The wires of the 310 continuity loop on the boosters or other thermally sensitive areas would feed into detector/processor 210, for display or down link with other horizontal grid elements 225 and vertical grid elements 200. This would allow a relatively complete, real-time "thermal integrity" check of all relevant vehicle surfaces and seams or other thermally sensitive areas or components. Should the integrity of any of these components be comprised, both the ground station and on-board personnel would have timely information to make critical decisions after launch and before proceeding to orbit, as well as while in orbit and before initiating re-entry. This, for example, allows on-board or ground personnel to initiate a safe-glide return alternative, after launch, and before a vehicle goes into orbit, or to choose alternatives to re-entry if any vehicle thermal-surface integrity compromise is detected before dropping out of orbit. --

11. Please amend the paragraph at page 14, lines 12-20 by replacing it with the following rewritten paragraph:

-- Finally, in the event of thermal protective layer form that may produce cavities of empty space beneath the protective layer's surface, 270 pressure sensing devices would act as a redundant detectors of compromise. That is, in addition to the protection-grid and telemetry resulting from it, pressure sensors within hallow cavities would produce separate telemetry of pressure changes. An example of this would be the hollow area between re-enforced carbon-carbon elements on the leading edge of a shuttle's wing, and the flat forward edge of the wing itself. As such, if there is a precipitous change of pressure within such a cavity and trauma to the detection grid, then the two independent telemetry sources would indicate crew and vehicle safety is compromised or may soon be compromised during continued operation of the vehicle. --

12. Also, please delete the paragraph entitled "ABSTRACT" which follows claim 7, at page 16, lines 10-17. Applicant is providing a replacement abstract on a separate sheet, as required by the Patent Office. The replacement abstract is annexed herein as Exhibit D.